$(a+bi)^x$

$(m\,\mathrm{cis}\,\theta)^x$

$m^x\,\mathrm{cis}\,\theta x$

$(r\,\mathrm{cis}\,\theta)$

CUBE ROOTS

$8i$

$(8i)^{\frac{1}{3}}=$

DIST: $\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

$8\,\mathrm{cis}\frac{\pi}{2}$ $r=2$ $3\theta=\frac{\pi}{2}+2\pi k$ $=\frac{\pi}{6}+\frac{2\pi}{3}k$

① $k=0$ $r=2$ $\theta=\frac{\pi}{6}$

$2(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6})$

$2(\frac{\sqrt{3}}{2}+i/2)$

$\sqrt{3}+i$

② $r=2$ $k=1$ $\theta=\frac{5\pi}{6}$

$2(\cos\frac{5\pi}{6}+i\sin\frac{5\pi}{6})$

$2(\frac{-\sqrt{3}}{2}+1/2)$

$=-\sqrt{3}+i$

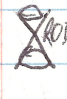
$r=2$ $k=2$ $\theta=\frac{3}{2}\pi$

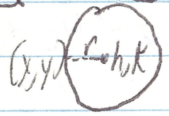
$2(\cos\frac{3\pi}{2}+i\sin\frac{3\pi}{2})$

$2(0-i)=-2i$

CONICS

CIRCLE





CIRCLE

$r=\sqrt{(x-h)^2+(y-k)^2}$

$r^2=(x-h)^2+(y-k)^2=x^2+y^2-8x+2y-3=0$

$Ax^2+Ay^2+Bx+Cy+D=0$ ~~$x^2-8x+16$~~ ~~x^2+y^2-8x+~~

$x^2-8x+16+y^2+2y+1=3+1+16$

$y=mx+b$

$m=$slope $b=y$ int

slope $=\frac{\Delta y}{\Delta x}$

$x^2+y^2-4x+6y-36=0$

$x^2-4x+4+y^2+6y+9=36+4+9$

$(x-2)^2+(y+3)=49$

$x^2+y^2+2x-10y+22=0$

$x^2+2x+1+y^2-10y+25=4$

$(x+1)^2+(y-5)^2=2^2$

$r=2$ $(-1,5)$

$x^2+y^2-6x-4y+4=0$

$x^2-6x+9+y^2-4y+4=9$

$(x-3)^2+(y-2)^2=3^2$

$r^2=(5^2)+(4^2)$

$(x-5)^2+(x+4)=41$ $r^2=41$

$(-2,7)$ $(0,1)$ $(2,-1)$

$4+49-2B+7C+D=0$

$1+0B+1C+D=0$

$4+1+2B-C+D=0$

$-2B+7C+D=-53$

$C+D=-1$ $-C=D+1$

ADD

$2B-C+D=-5$ → ~~$2B+D+1=-5$~~ or $2B+D=-6$

$-2B-D=6$

$-2B=6+D$

$6C+2D=-58$

$3C+D=-29$

$-(C+D=-1)$

$2C=-28$

$C=-14$

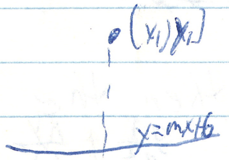
$D=13$

$2B+14+13=-5$

$2B+27=-5$

$2B=-32$

$B=-16$



POINT TO LINE

$d=\frac{|mx_1+b-y_1|}{\sqrt{1+m^2}}$

$2x+3y=6$

$3y=6-2x$

$y=2-\frac{2}{3}x$

$(x+2)^2+(x+3)^2=\frac{19^2}{13}$

TAN TO $2x+3y=6$ cntr$(-2,-3)$

$-2\cdot-\frac{2}{3}+2+3=\frac{4}{3}+1=\frac{19}{3}$

$\frac{\sqrt{5}}{3}$

$\frac{19/3}{\sqrt{\frac{13}{9}}}=\frac{19/3}{\sqrt{13}/3}=\frac{19}{\sqrt{13}}=\frac{\sqrt{13}}{13}$

$Ax^2+y^2+Bx+Cy+D=0$

$4+25+2B+5C+D=0$

$29+2B+5C+D=0$
$49+0+7C+D=0$
$37+-6B+C+D=0$

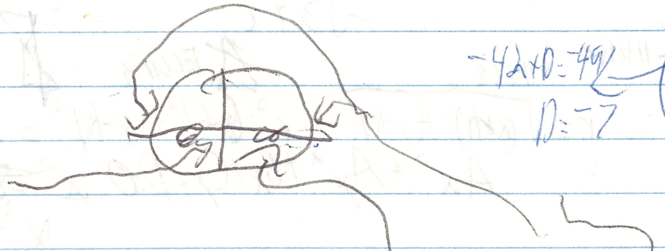
~~$4+2B+5C+D=0$~~

$2B+5C+D=-29$
$7C+D=-49$
$-6B+C+D=-37$
~~$2C-2B=-20$~~
~~$C-B=-10$~~
$6B+15C+3D=-87$
$-6B+C+D=-37$
$16C+4D=-124$
$4C+D=-124$

$-42+D=-49$
$D=-7$

$7C+D=-49$
$-(4C+D)=$ ~~-124~~ -31
$3C=$ ~~25~~ -18
$c=-6$
$d=-7$

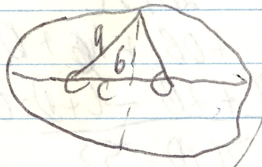
$(x-6)^2+y^2=r^2$ $r=\frac{|mx+b-y|}{\sqrt{1+m^2}}=\frac{10}{\sqrt{\ }}$



equidistant from 2 points focal axis vertices

ELLIPSE $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ major axis

minus plus times dives



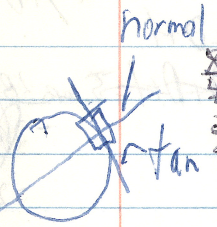
$a^2=b^2+c^2$, $c=\sqrt{a^2\overset{\text{minus}}{-}b^2}$

$\frac{9x^2}{144}+\frac{16y^2}{144}=1$
$\frac{x^2}{16}+\frac{y^2}{9}=1$

$(\pm8,0)$

$\frac{x^2}{64}+\frac{y^2}{100}$

$c=$ foci
$b=$ min
$a=$ maj



~~$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$~~
$\frac{25}{a^2}+\frac{9}{b^2}=1$
$25+\frac{9a^2}{b^2}=1$
$25b+398=1$

$\frac{x^2}{b^2}+\frac{y^2}{84}=1$
$x^2+\frac{b^2y^2}{84}=1$
$25+9b^2/84=1$
$2100+9b^2=84b^2$
$2100=75b^2$
$1.84=3b^2$

$ecc=\frac{c}{a}$

$\frac{3x}{84}+\frac{5y}{28}=1$

$3x+15y=84$
$15y=-3x+84$
$y=\frac{-3}{15}x+\frac{84}{15}$
$y=\frac{-1}{5}x+\frac{28}{5}$

If $P(g,h)$ is on $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ then the EQ of ~~ellipse~~ line tan to ellipse is $\frac{gx}{a^2}+\frac{hy}{b^2}=1$

$x^2+2y^2+10x-4y+29=0$
$x^2+10x+25\ \ 2y^2-8y+4=-29+25+8$
$x^2+10x+25+2(y^2-4y+4)=4$
$(x+5)^2+2(y-2)^2=4$

$\frac{(x+5)^2}{4}+\frac{(y-2)^2}{2}=1$
$c(-5,2)$ horiz
$a=\pm2$, $b=\pm\sqrt{2}$
foci $=(-5\pm\sqrt{2},2)$

arith prog $S_n = \frac{n}{2}(2a+(n-1)d)$ $\frac{n}{2}(a+a_n)$

$a_n = a+(n-1)d$

geo prog $S_n = \frac{a(1-r^n)}{(1-r)}$ $a_n = ar^{n-1}$

~~inf~~ $S_\infty = \frac{a}{1-r}$

① $S_{20} = 10(\overset{2}{\cancel{4}} + (19)\overset{1}{\cancel{2}}) =$ ~~420~~ 210

② $x^2+y^2 = 6y$

$\cancel{x^2+y^2}\ r^{\cancel{2}} = 6\cancel{r}y$

$r = 6\frac{y}{r}$

$r = 6\sin\theta$

$(4\text{cis}30)^3 = 64\text{cis}90$

$64i$

$x^4 - 8y^2 \cancel{+} 3x+1 \div x+3$

$-3\,|\ 1\ \ 0\ \ -8\ \ -3\ \ +1$

58° ρ°01 $-3\ \ 9\ \ -3\ \ 18$

$1\ \ -3\ \ 1\ \ -6\ \ ⑲$

575/17-23 odd

Alex Gzygan

⑰ $3x - 4y = 2$

$3(r\cos\theta) - 4(r\sin\theta) = 2$

$r(3\cos\theta - 4\sin\theta) = 2$

$r = \frac{2}{3\cos\theta - 4\sin\theta}$

⑲ $y^2 = x3$

$\frac{y^2}{x^2} = x$

$\tan^2\theta = r\cos\theta$

$r = \frac{\tan^2\theta}{\cos\theta}$ or $\tan^2\theta \sec\theta$

㉑ $2xy = 1$

$2(r\cos\theta)(r\sin\theta) = 1$

$2r^2(\cos\theta\sin\theta) = 1$

$r^2 = \frac{1}{2\cos\theta\sin\theta}$ or $\frac{\csc\theta\sec\theta}{2}$

㉓ $9x^2 + x^2 = 9$

~~$9(r^2\cos^2\theta + r^2\sin^2\theta) = 9$~~

$9r^2 = 9$

$r = 9$

$9(r^2\cos^2\theta + r^2\sin^2\theta) = 9$

$r^2 = \frac{1}{\cos^2\theta + \sin^2\theta}$

$2+3i$
$5-6i$

$\frac{1575}{1440}$
$\underline{\quad}$
135

Alex Lozupone

⑮ $4x^3+x^2-20x-5=0$ $\left\{\frac{5}{4,2,1}\right\}$: $5, 2, \frac{5}{2}, \frac{5}{4}, 1, \frac{1}{2}, \frac{1}{4}$

$\frac{1}{4}\lfloor 4 \; +1 \; -20 \; -5$
$4 \quad 1 \quad -19\frac{3}{4} \quad 10$

$4x^2-20=$ [illegible] $2x^2-10=x^2-5$ $(x+\sqrt{5})(x-\sqrt{5})$

$-\frac{1}{4}\lfloor 4 \quad 1 \quad -20 \quad -5$
$\quad -1 \quad 0 \quad 5$
$4 \quad 0 \quad -20 \quad 0$ ✓

$\sqrt{i}\sqrt{i}=\sqrt{i^2}=i$
$\sqrt{-1}\sqrt{-1}=-1$
$\sqrt{-1}\sqrt{-1}=\sqrt{1}=1$

$-\frac{1}{4}, \sqrt{5}, -\sqrt{5}$

⑲ $x^4+x^3-25x^2-x+24=0$ $\left\{\frac{24}{1}\right\}$: $1, 2, 3, 4, 6, 12, 24$
(x^2+x-24) $\frac{-1\pm\sqrt{1+96}}{2}$

$1\lfloor 1 \; +1 \; -25 \; -1 \; +24$
$\quad 1 \quad 2 \quad -23 \quad -24$
$-1\lfloor 1 \quad 2 \quad -23 \quad -24 \quad 0$
$\quad -1 \quad -1 \quad 24$
$1 \quad 1 \quad -24 \quad 0$

$1, -1, \frac{1+\sqrt{97}}{2}, \frac{1-\sqrt{97}}{2}$

POS ㉙ $x^3+x-1=0$
$.68<x<.69$

$-1, 10+3i+18=28+3i,$
$5-9i$

$\sqrt{\cancel{2}}$

$(\sqrt{2}-\sqrt{2}\,i)^5$

$2(\operatorname{cis}315)^5$
$32(\operatorname{cis}1575)$
~~cos 45~~ $-\sin 45$
$32(\cos 45+i\sin 45)$
$32\left(\frac{\sqrt{2}}{2}+\frac{\sqrt{2}\,i}{2}\right)$

㉛ $x^5-200=0$
$2.88<x<2.89$

$-16\sqrt{2}+16i\sqrt{2}$

㉝ $x^3-8x^2+21x-22=0$

$4.31<x<4.32$

NEG ㉟ $x^3+x^2-2x+1=0$

$-2.15<x<-2.14$

$32768($

$16384\sqrt{2}+i16384\sqrt{2}$

㊲ $x^3+2x^2+2x+101=0$

$-5.27<x<-5.26$